

An Approach to Health Management and Sustainability for Critical Aircraft Systems, Phase I

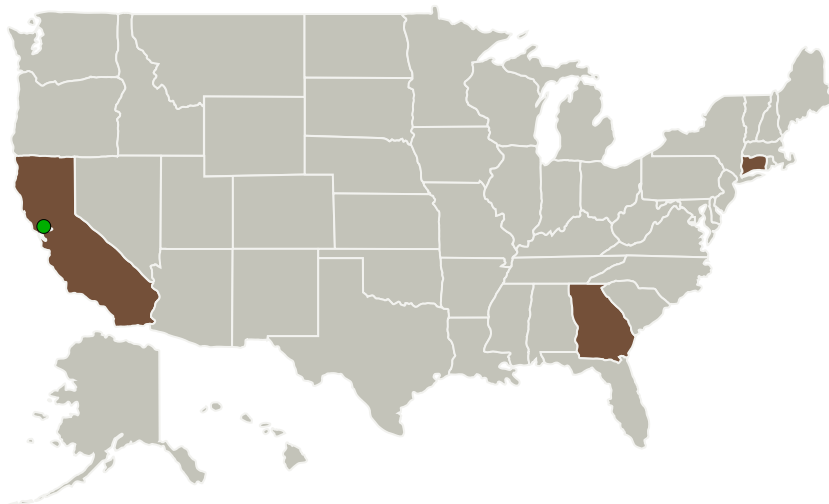
Completed Technology Project (2010 - 2011)



Project Introduction

Impact Technologies, in collaboration with the Georgia Institute of Technology and its industrial partners, proposes to develop and demonstrate innovative technologies to integrate anomaly detection and failure prognosis algorithms into automated fault mitigation strategies for advanced aircraft controls. Traditional reactive fault tolerant control approaches fail to provide optimal fault mitigation over a long period of time to guarantee the integrity of the platform for the mission duration. We will create a generic simulation environment to demonstrate fault detection and progression at the component level, using electromechanical actuators as a testbench. The proposed Anomaly Detection/Mitigation system accepts sensor inputs, extracts features from raw data and employs an anomaly detection module to determine the presence of an anomaly with performance guarantees; a prognostic routine, built on Bayesian estimation (particle filtering) techniques to estimate the remaining useful life of the component; finally, a mitigation strategy trades off between performance and control authority to extend the life of the failing component until the mission is completed. This innovative prognostics-enhanced approach to fault mitigation uses Model Predictive Control techniques running in real time. Core algorithms will be implemented on embedded systems and used in hardware-in-the-loop demonstrations.

Primary U.S. Work Locations and Key Partners



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| Organizations Performing Work | Role | Type | Location |
|--|-------------------------|-------------|---------------------------|
| Sikorsky Aircraft Corporation | Lead Organization | Industry | Stratford, Connecticut |
| ● Ames Research Center(ARC) | Supporting Organization | NASA Center | Moffett Field, California |
| Georgia Institute of Technology-Main Campus(GA Tech) | Supporting Organization | Academia | Atlanta, Georgia |

Primary U.S. Work Locations

| | |
|------------|-------------|
| California | Connecticut |
| Georgia | |

Project Transitions

▶ **January 2010:** Project Start

✓ **January 2011:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140652>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Sikorsky Aircraft Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

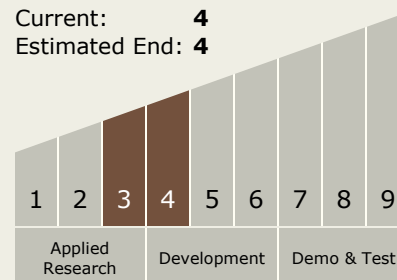
Carlos Torrez

Principal Investigator:

George Vachtsevanos

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
 - └ TX13.2 Test and Qualification
 - └ TX13.2.6 Advanced Life-Cycle Testing Techniques

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System